A taxonomic revision of *Claoxylon* A.Juss. (Euphorbiaceae) in Australia

Paul I. Forster

Summary

Forster, P.I. (2007). A taxonomic revision of *Claoxylon* A.Juss. (Euphorbiaceae) in Australia. *Austrobaileya* 7(3): 451–472. The genus *Claoxylon* A.Juss. comprises four species in Australia, exclusive of Christmas Island, namely: *C. angustifolium* Müll.Arg., *C. australe* Baill., *C. hillii* Benth. and *C. tenerifolium* (F.Muell. ex. Baill.) F.Muell. *Claoxylon hillii* is reinstated from the synonymy of *C. tenerifolium. Claoxylon tenerifolium* comprises two subspecies with subsp. *boreale* P.I.Forst. newly described from the 'Wet Tropics' of north-eastern Queensland. All taxa are described and illustrated, together with notes on typification, variation, distribution, habitat, conservation status and etymology. A lectotype is designated for *Mercurialis tenerifolia* F.Muell. ex Baill. (= *Claoxylon tenerifolium* (F.Muell. ex Baill.) F.Muell.).

Key Words: Euphorbiaceae, *Claoxylon*, *Claoxylon hillii*, *Claoxylon tenerifolium* subsp. *boreale*, Australia, Australian flora, taxonomy, nomenclature, typification, identification key

P.I.Forster, Queensland Herbarium, Environmental Protection Agency, Brisbane Botanic Gardens, Mt Coot-tha Road, Toowong, Queensland 4066, Australia. Email: paul.forster@epa.qld.gov.au

Introduction

The genus *Claoxylon* was described by Jussieu (1824) based on the single species *C. parviflorum* A.Juss. from the Mascarenes (Reunion and Rodrigues). Approximately 113 species are currently recognised (Govaerts *et al.* 2000), and are distributed in the Old World tropics in Madagascar, the Mascarenes, Asia, Malesia, Australia and the western Pacific as far east as Hawai'i. *Claoxylon* was included by Webster (1994) in Euphorbiaceae subfamily *Acalyphoideae* Asch., tribe *Acalypheae* Dumort, subtribe *Claoxylinae* Hurus. together with *Amyrea* Baill., *Claoxylopsis* Leandri, *Discoclaoxylon* (Muell.Arg.) Pax & K.Hoffm., *Erythrococca* Benth., *Mareya* Baill. and *Micrococca* Benth. Radcliffe-Smith (2001) had a similar arrangement but excluded *Amyrea* and *Mareya* from this subtribe. Recent molecular based phylogenies have placed *Claoxylon* in a clade with *Discoclaoxylon*, *Erythrococca*, *Lobanilia* Radcl.-Sm. and *Micrococca* (Wurdack *et al.* 2005). Taxa included in this genus have a unique character of the dry leaf surface being 'rough' due to slightly protruding styloid crystals (Kabouw *et al.* 2007). Whilst there have been a number of regional accounts of *Claoxylon* (e.g. India: Rani & Balakrishnan 1995; New Guinea: Airy Shaw 1980a; Thailand: van Welzen 2005), the last overall revision was by Pax (1914).

A specimen of *Claoxylon* was first collected from Australia by Joseph Banks and Daniel Solander when they were marooned at the Endeavour River between 17 June and 3 August 1770 following the collision of Captain Cook's ship the H.M.B. Endeavour on the Great Barrier Reef. This material (*Claoxylon hillii* Benth.) was illustrated by Sydney Parkinson (available online at www.jbanks.com) and specimens are present in a number of herbaria (e.g. BM, NSW). The first species of *Claoxylon* formally recognised for Australia was *C. australe* Baill. based on a collection by the explorer Ludwig Leichhardt in 1845 (Baillon 1858). This was quickly followed by the descriptions of *C. angustifolium* Müll.Arg. (Müller 1865) and *Mercurialis tenerifolia* F.Muell. ex Baill. (Baillon 1866), the latter subsequently recombined as *C. tenerifolium* (F.Muell. ex Baill.) F.Muell. (Mueller 1868). Bentham (1873) added *C. hillii* Benth. and the varieties *C. australe* var. *latifolia* Benth., *C. australe* var. *laxiflora* Benth. and *C.australe* var. *dentata* Benth. These concepts were repeated by Bailey (1901) and it was not until Airy Shaw (1976, 1980a,b, 1981) revised the Australian Euphorbiaceae in part, that any change to the *status quo* was

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attempted. Airy Shaw placed *Claoxylon hillii* in synonymy with *C. tenerifolium*, and also reduced Bentham's varieties of *C. australe* to synonymy with *C. australe* and *C. tenerifolium* respectively. The concept of three Australian species of *Claoxylon* was maintained until recently (e.g. Forster & Henderson 1997; Govaerts *et al.* 2000; Forster & Halford 2002), with the name *C. tenerifolium* being widely used for a 'species' that occurred from southern Queensland, north to tropical parts of Queensland, Western Australia and the Northern Territory (Wheeler 1992; Dunlop *et al.* 1995) and southern New Guinea (Airy Shaw 1980a).

The current revision is limited to mainland Australia and immediate offshore continental islands and coral cays. The Australian territory of Christmas Island has populations of *C. indicum* (Reinw. ex Blume) Hassk. (otherwise widespread in Malesia, Indochina and mainland Asia), and an account of this species is given by Du Puy & Telford (1993) together with illustrations in Claussen (2005). A much greater number of collections from mainland Australia are now available than were available to Airy Shaw (1980b, 1981). It is now evident that his reduction of *Claoxylon hillii* to synonymy with *C. tenerifolium* was in error as there are a number of easily discernible diagnostic characters that enable separation of the two as species. In addition, description of one new subspecies of *Claoxylon tenerifolium* is now possible following collection of adequate flowering material in 2001.

General Ecology & Reproductive Biology

The ecology of *Claoxylon* species has been barely studied and most information is merely anecdotal with respect to their reproduction, pollination, dispersal and recruitment as in the case of *Actephila* (Forster 2005). Unlike *Actephila*, the Australian species of *Claoxylon* can be interpreted as pioneers within the rainforest habitat due to their occurrence predominantly on the margins, in areas of disturbance or of high incident radiation (e.g. fragmented vinethicket canopies). While plants of *Claoxylon* are able to persist in shaded situations, they may exhibit increased numbers following gap formation or removal of competing plants (e.g. *Lantana camara*; Macleay 2004) and are generally considered to be light demanding (Green *et al.* 2004), although some non-Australian species appear well suited to life in the understorey in terms of their being able to reach maturity and reproduce (Pearcy 1983; Pearcy & Calkin 1983).

The four Australian species of *Claoxylon* appear dioecious as a population consists of plants that have either staminate or pistillate of flowers. Occasionally 'male' plants will have a few pistillate flowers in the inflorescences indicating that they may be actually monoecious. Species of *Claoxylon* are stated to be 'usually dioecious' (Floyd 1989; Wheeler 1992; James & Harden 2000; Adam & Williams 2001) or 'dioecious or rarely monoecious' (Bentham 1873; Bailey 1901; Stanley 1983; Florence 1997; Radcliffe-Smith 2001), although elsewhere they are listed as 'dioecious' (Smith 1981), 'monoecious' (Sakai *et al.* 1995) or 'monoecious or dioecious' (Wagner *et al.* 1989). Whether the apparent dioecy of the Australian taxa is fixed or subject to gender diphasy (the plants 'change sex') or is merely a case of androdioecy (male only and hermaphroditic individuals) is not known and requires long term observation of individual plants. In the Australian species the staminate flowers are usually larger in size than the pistillate ones (though not in *C. angustifolium*), a trait repeated outside of the region (Humeau *et al.* 2003). Additionally, staminate inflorescences and the overall number of staminate flowers greatly out numbers pistillate ones within any given population (pers. obs.).

The pollination dynamics of *Claoxylon* are unknown. Wind pollination is listed by Sakai *et al.* (1995); however, this is unlikely for a number of reasons. In many cases the plants are within the understorey of the rainforest, where windspeeds are much reduced (Turner 2001). The flowers are small and insignificant but generally conform to the shallow, bowl-like pattern that is considered suited to generalist insect pollinators (Endress 1994). Their general form is not dissimilar to those of either *Actephila* Blume or *Croton* L., both thought to be insect pollinated (Forster

2003, 2005). The pollen of *Claoxylon* (based mainly on taxa outside of Australia) is of a generalised type and has tecta that are punctate-microspinulose (Nowicke *et al.* 2002). This tends to support the suggestion that wind pollination is unlikely if the hypothesis of Williams & Adam (1999) that rainforest taxa with smooth pollen are more likely to be wind pollinated is eventually proven valid. Abe (2006) listed bee, fly and wind pollination systems for *C. centenarium* Koidz. from the Ogasawara Islands, but did not provide any experimental details of their individual effectiveness.

Fruiting is usually a mass event for a 'female' *Claoxylon*. The seeds (with covering arils) are not shed from the capsules following dehiscence, but remain attached to the central columella often with complete shedding of the fruit endocarp. The individual fleshy arils (usually orange to orange-red) are visually striking to the human eye and are attractive to birds (**Table 1**) that disperse the seeds (zoochory) (Innis 1989; Kitamura *et al.* 2002). The presence of some widespread species on isolated islands (e.g. *C. indicum* on Christmas Island) has been attributed to long range dispersal by arboreal avifauna (Whittaker *et al.* 1997). Ornithologist S. Legge (http://www.birdhealth.com.au/bird/eclectus/research.html) has noted that Eclectus Parrots eat only the aril of *Claoxylon hillii* but not the seeds and further research is required to see if this parrot also disperses the seeds. In some species the endocarp also colours yellow (e.g. *Claoxylon fallax* Müll.Arg. from Tonga; Meehan *et al.* 2002) or pale orange (*C. tenerifolium*) when the fruits are ripe, further supporting the hypothesis of zoochorous dispersal. Saulei & Swaine (1988) found with *C. ledermanii* Airy Shaw from New Guinea that the appearance of the species in rainforest successional stages was due to seed rain (presumably from avian dispersal) rather than any stored seed bank.

Table 1. Records of birds feeding on fruit of Australian *Claoxylon* species

Claoxylon species	Birds feeding on fruit	Reference
C. australe	Brown Cuckoo Dove; King Parrots	Floyd 1989; Innis 1989
C. hillii	Eclectus Parrot	Cooper & Cooper 2004
C. tenerifolium	Brown Cuckoo Dove	Cooper & Cooper 2004

Materials and methods

This revision is based on herbarium holdings at AD, BRI, CANB (including CBG), DNA, MEL, NSW, PERTH and QRS, selected type material at K and G, and field collections and observations by the author of all species. Venation data in the species descriptions follow the terminology of Hickey (1973) and Ash *et al.* (1999). In their scheme the different components of venation are described using a numerical system with the recognition of a midrib (1° vein order), lateral veins (2° vein order) and intercostal veins (3° and onwards vein orders) within any leaf lamina. When an intercostal vein comprises a continuous raised line of cells it is termed 'distinct'; if it is discontinuous or fades away into the body of the lamina, it is termed 'indistinct'. Indumentum cover is described using the terminology of Hewson (1988), except that 'scattered' is used instead of 'isolated'. The shapes of leaves, sepals and petals are described using the terminology of Hickey & King (2000).

Species are defined as groups of populations (1-many) with discontinuities in two or more independent character states of morphology. If a single character state difference is present, or there is repeatable variation in minor characters such as indumentum cover, and where the discontinuity is geographically based, then the rank of subspecies is used. These are species and subspecies definitions that are widely used and understood (Stebbins

1950; van Steenis 1957; Cronquist 1988; Stace 1989; Stuessy 1990; Levin 1979, 2000), the former equating to the 'diagnostic species' concept of Judd *et al.* (2002). This concept as used herein is tied to habitat preference and geographic distribution, based on extensive fieldwork in New South Wales, the Northern Territory and Queensland over the last 20 years.

Common abbreviations: N.P. = National Park; S.F.R. or S.F. = State Forest Reserve; L.A. = Logging Area. Rainforest structural terminology follows Webb (1978). The 'Wet Tropics' is defined as that area of north-eastern Queensland which encompasses the 'hot, humid vine forests' from near Cooktown in the north to Paluma in the south (Webb & Tracey 1981), and is equivalent to the bioregion of the same name (Goosem *et al.* 1999). 'Cape York Peninsula' is that part of Queensland north of the 'Wet Tropics'.

Taxa are arranged alphabetically. *Claoxylon indicum* is included in the key to species but is not treated in the main text. An account of that species can be found in Du Puy & Telford (1993).

Taxonomy

Claoxylon A.Juss., *Euphorb. Gen.* 43, t. 14, f. 43 (1824). **Type:** *C. parviflorum* A.Juss.

***Etymology*:** from the Greek *klao* (I break) and *xylon* (wood); alluding to the brittle wood.

Shrubs or small trees, evergreen or deciduous, perennial, monoecious or dioecious; stems and foliage without latex. Indumentum of simple, multicellular trichomes, glandular trichomes absent, stinging trichomes absent. Stipules entire, inconspicuous, deciduous. Leaves alternate, petiolate, elobate, penninerved, crenate or serrate, usually purple when young, drying dull-green, purple-black or blue-black and with a 'rough' surface due to slightly protruding styloid crystals, glands absent or foliar only. Inflorescences axillary or lateral, racemose, solitary, fasciculate or racemulose with flowers in bracteate glomerules, bisexual. Staminate flowers pedicellate; calyx lobes 2–4, valvate, free and ± equal; petals absent; disk of numerous interstaminal glands; stamens 10–200, filaments free and attached to a slightly convex receptacle; anthers basifixed, bilobate, thecae globose to oblong and longitudinally dehiscent; pistillodes absent. Pistillate flowers pedicellate; calyx lobes 3, valvate, shortly connate; petals absent; disk hypogynous, annular; ovary 2–4-locular, ovules uniloculate; styles shortly connate at base, simple and spreading. Fruits capsular, trilobate, surface smooth, dehiscing septicidally into 3 bivalved cocci. Seeds globose, ecarunculate, arillate; testa crustaceous, foveolate or reticulate; albumen fleshy; cotyledons broad, flat.

Approximately 110 species in the Old World Tropics. Four species in Australia, three endemic.

Key to the Australian and Christmas Island species of *Claoxylon*

1 Leaf laminae linear-lanceolate to elongate-elliptic; 2° veins > 15 per side of 1° vein (midrib); inflorescences up to 40 mm long . . . . . **1. C. angustifolium**
Leaf laminae elliptic, obovate, obovate-oblong or oblanceolate; 2° veins < 12 per side of 1° vein (midrib); inflorescences up to 180 mm long **2**

2 Leaf laminae with pocket domatia at junction of 1° and 2° veins; male flowers 10–15 per glomerule . . . . . **3. C. hillii**
Leaf laminae lacking pocket domatia at junction of 1° and 2° veins; male flowers 1–6 per glomerule **3**

3 Leaf laminae chartaceous . . . . . **4. C. tenerifolium**
Leaf laminae coriaceous **4**

4 Leaf laminae linear-lanceolate to elongate-elliptic; inflorescence bracts glabrous or with scattered indumentum; styles subulate . . . . . **2. C. australe**
Leaf laminae elliptic to ovate; inflorescence bracts with dense indumentum; styles flabellate. . . . . **C. indicum**

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1. Claoxylon angustifolium Müll.Arg., *Linnaea* 34: 165 (1865); *Mercurialis angustifolia* (Müll.Arg.) Baill., *Adansonia* 6: 322 (1866). **Type:** Queensland. South Kennedy District: Port Denison, *E.Fitzalan s.n.* (holo: G-DC *n.v.*, fiche at BRI!; iso: MEL).

Shrub or small tree to 4 m high, evergreen, dioecious, rarely monoecious. Indumentum of simple trichomes, generally antrorse, clear to yellow. Stems rounded, 1.5–2 mm diameter in leaf bearing branchlets, grey, lenticellate, with scattered indumentum when young, glabrescent. Stipules, small, acuminate to subulate, 0.3–0.5 × 0.2–0.3 mm, with sparse indumentum. Leaves: petioles 3–26 × 0.8–1 mm, grooved on top, glabrous, or with scattered indumentum; laminae linear-lanceolate to elongate-elliptic, coriaceous, 40–240 × 4–30 mm, discolorous, 1° and 2° venation weakly developed, 3° and onwards venation ± obscure, 1° venation comprising 16–20 veins per side of midrib; tip acuminate, acute or rounded; base attenuate to cuneate; margins dentate to denticulate, with 11–22 antrorse teeth per side, each tooth up to 0.5 mm long and tipped with an extrafloral nectary and sometimes with a tuft of trichomes; upper surface dark glossy green, 2° onwards venation ± obscure, glabrous or with scattered trichomes when young; lower surface pale blue-green, venation weakly developed, 1° raised below, 2° slightly raised below, 3° and onwards indistinct, glabrous or with sparse indumentum when young, minute pocket domatia absent; extrafloral nectaries 1 or 2 just above lamina base, circular-ellipsoid, shortly stipitate, glabrous. Inflorescences up to 40 mm long, unisexual; peduncle 9–15 mm long, with scattered to sparse indumentum; bracts lanceolate, 0.8–1 × *c.* 0.3 mm, with sparse indumentum. Staminate flowers 1–5 in glomerules, buds umbonate, apiculate; pedicels filiform, 6.5–10 × 0.1–0.2 mm, with scattered indumentum; sepals 3, lanceolate-ovate, 1.5–2.5 × 1.5–2 mm, glabrous; receptacle of narrow, erect glands interspersed with stamens, glabrous; stamens 12–15, filaments 1–1.5 × *c.* 0.2 mm, glabrous, anthers 0.3–0.4 × 0.3–0.4 mm. Pistillate flowers held singly, pedicels filiform, 7–13 × 0.1–0.3 mm, with scattered indumentum; sepals ovate to orbicular, 1.2–1.6 × 0.8–1.8 mm, with scattered indumentum; disk 0.7–0.8 mm long, glabrous; ovaries 1–2 × 1.2–2.2 mm, with dense, adpressed indumentum; styles acute, 0.4–0.5 × 0.2–0.3 mm, not noticeably papillate, glabrous. Fruits depressed-globose, 4–5 × 6–8 mm, green (drying grey-green), with dense adpressed indumentum, rarely glabrescent, sutures of adjacent cocci with a marked groove and with a slight ridge. Seeds with a fleshy red aril, testa 2–3 × 2–3 mm, fawn brown. **Fig. 1.**

***Additional selected specimens examined*: Queensland.** Cook District: Daintree N.P., Adeline Creek Headwaters, Candlenut Scrub, 16°07′S, 145°03′E, May 1999, *Forster PIF24597 & Booth* (BRI); Daintree N.P., Adeline Creek headwaters, top of hill 929, 16°09′S, 145°02′E, May 1999, *Forster PIF24531 & Booth* (BRI, MEL, QRS); S.F.R. 144 Windsor Tableland, Oct 1971, *Hyland 5572* (BRI, QRS); S.F.R. 607 Speerwah, Sep 1959, *Dansie 1907* (BRI); S.F.R. 607, Bridle L.A., Nov 1973, *Hyland 7131* (BRI, QRS); S.F.R. 185, Downfall L.A., Apr 1971, *O'Farrell 18* (BRI, QRS). North Kennedy District: Dryander Creek, middle branch, SE base of Mt Dryander, 20°15′S, 148°34′E, Jun 1989, *Forster PIF5173 & Tucker* (BISH, BRI, MO); Hook Island, Nov 1985, *Batianoff 3612* (BRI); Hill inlet near White Haven Bay, Whitsunday Island, Nov 1985, *Batianoff 3615 & Dalliston* (BRI); Daydream Island, Whitsunday region, 20°15′S, 148°53′E, Apr 1990, *Batianoff 900424* (AD, BRI, MEL); Charley Creek, Woodwark Bay, 20°16′S, 148°39′E, Mar 1994, *Batianoff 9403446* (BRI); Conway Range N.P., 20°17′S, 148°46′E, Apr 1991, *Forster PIF8218* (BRI, K, L, MEL, QRS); Track to Swamp Bay, Conway Range N.P., 20°17′S, 148°47′E, Nov 1985, *Sharpe s.n.* (BRI [AQ423758]); Hayward Creek, Conway N.P., Shute Harbour, *c.* 35 km NE of Proserpine, 20°18′S, 148°45′E, Nov 1985, *Sharpe 4146* (BRI); S.F. 299 Conway, Brandy Creek road, 8 km S of Airlie Beach, 20°20′S, 148°42′E, Feb 2004, *Forster PIF29976 et al.* (A, BRI, L, MEL, NSW, Z); Anderson Bay, Conway N.P., 20°22′S, 148°49′E, May 1994, *Batianoff 9405109 & Dillewaard* (BRI; L *n.v.*). South Kennedy District: S.F. 652 Cathu, 8.5 km along North road, 20°48′S, 148°28′E, Mar 1999, *Forster PIF24189 & Booth* (BRI, MEL); Pease's Lookout, Clarke Range, Eungella N.P., 21°06′S, 148°31′E, Apr 1991, *Forster PIF8055 & McDonald* (BRI, K, L, MEL, MO, QRS); Eungella N.P., Dalrymple road, 21°07′S, 148°30′E, Feb 2004, *Forster*

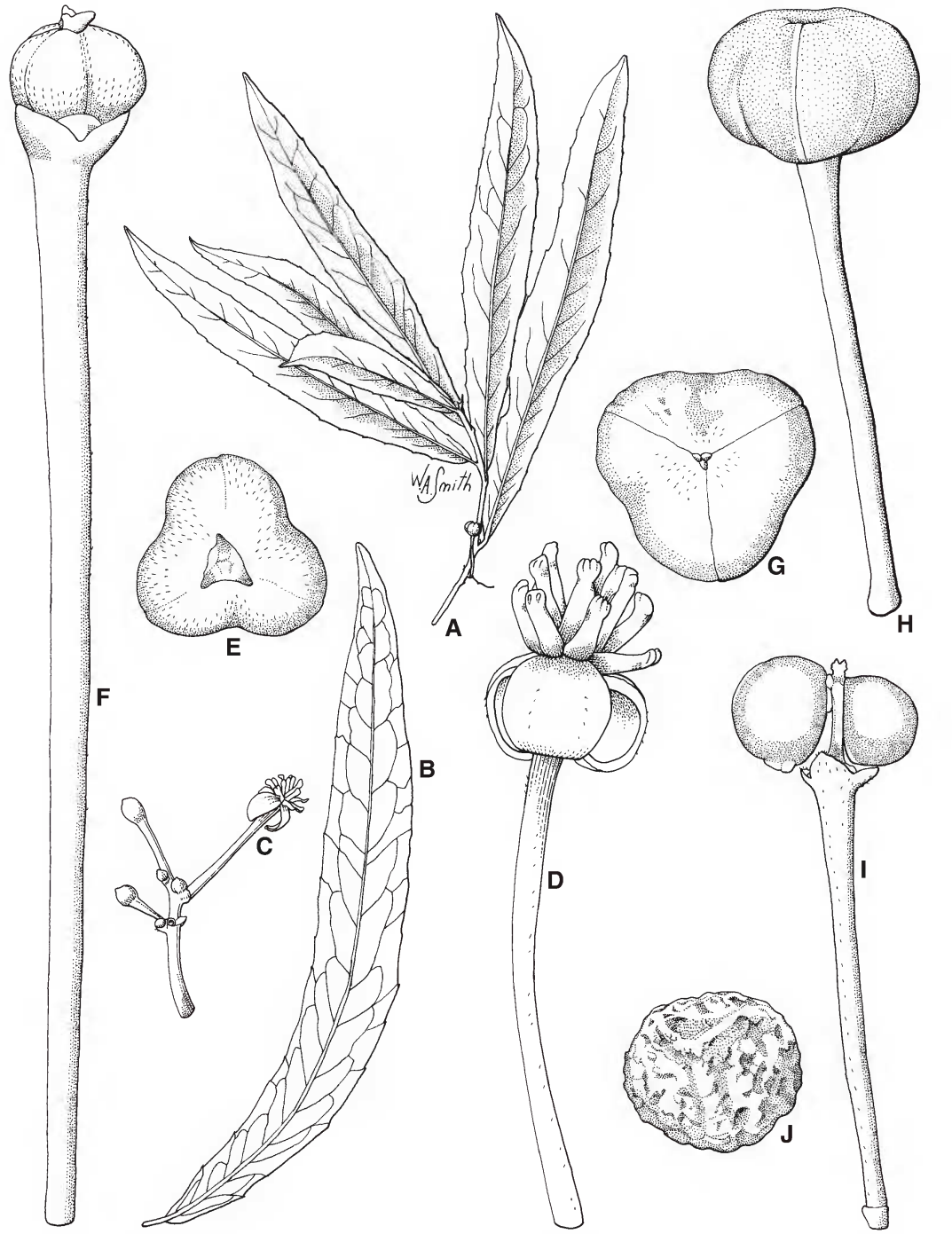

Fig. 1. ***Claoxylon angustifolium.*** A. fruiting branchlet × 0.4. B. leaf viewed from below and showing 1°–2° venation × 0.6. C. inflorescence with male buds and flower × 2. D. lateral view of male flower × 8. E. face view of female flower × 8. F. lateral view of female flower × 6. G. face view of fruit × 4. H. lateral view of fruit × 4. I. lateral view of fruit with dehisced capsule showing two seeds (with arils intact) *in situ* × 4. J. seed with aril removed × 8. A, B, G–J from *Forster PIF29976* (BRI); C & D from *Forster PIF8055* (BRI); E & F from *Forster PIF8092* (BRI). Del. W. Smith.

PIF30056 et al. (BRI); Broken River Walking track, Eungella N.P., 21°10′S, 148°30′E, Apr 1991, *Forster PIF8070 & McDonald* (BRI, K, MEL, QRS).

***Distribution and habitat*:** *Claoxylon angustifolium* is endemic in subcoastal central and north-eastern Queensland where it occurs in four 1° grid squares (**Map 1**). It is the most geographically restricted of the Australian species. The current northern limit is in the Daintree National Park at 16°07′S with the current southern limit at Broken River in Eungella National Park at 21°10′S. Plants grow either in, or on the margins of microphyll to notophyll vineforest, usually on granite substrates at altitudes between 5 and 925 m.

***Notes*:** This species is unique amongst the Australian taxa of *Claoxylon* in the long linear-lanceolate to elongate-elliptic leaf laminae with poorly developed venation and the exceptionally long filiform pedicels.

***Phenology*:** Flowers have been recorded from October to July, fruits from November to August.

***Conservation status*:** This species is widespread and not threatened. Present in Conway, Daintree, Eungella and Whitsunday Islands National Parks and State Forests 144, 185, 299, 432, 607, 652.

***Etymology*:** The specific epithet is derived from the Latin *angustus* (narrow) and *–folius* (leaved).

2. Claoxylon australe Baill., *Etud. Gen. Euph.* 493 (1858); *Mercurialis australis* (Baill.) Baill., *Adansonia* 6: 322 (1866); *Claoxylon australe* var. *australe*: Benth., *Fl. Austral.* 6: 131 (1873). **Type:** Nouvelle Hollande, [1845], [*L.*] *Leichhardt s.n.* (holo: P, *n.v.*; iso: MEL).

Claoxylon australe var. *laxiflora* Benth., *Fl. Austral.* 6: 131 (1873). **Type:** New South Wales, Tweed River, *C. Moore s.n.* (holo: K *n.v.*, photo at BRI!).

Claoxylon australe var. *dentata* Benth., *Fl. Austral.* 6: 131 (1873). **Type:** New South Wales, Macleay River, [*H.*] *Beckler s.n.* (holo: K *n.v.*, photo at BRI!).

***Illustrations*:** Floyd (1989: 140); James & Harden (1990: 407); Hauser (1992: 188); Williams (1999: 115); Logan River Branch S.G.A.P. (Queensland Region) Inc. (2005: 277); Harden *et al.* (2006: 109).

Shrub or small tree to 6 m high, evergreen, usually dioecious, rarely monoecious. Indumentum of simple trichomes, antrorse to divaricate, clear to straw. Stems rounded, 2–3 mm diameter in leaf bearing branchlets, cream, lenticellate, with scattered to dense indumentum when young, glabrescent. Stipules small, acuminate, *c.* 0.5 × 0.3 mm, glabrous or with scattered indumentum. Leaves: petioles 6–40 × 0.5–1 mm, grooved on top, glabrous or with scattered to dense indumentum; laminae cuneate-obovate, elliptic, obovate-oblong, coriaceous, 40–190 × 20–70 mm, discolorous, 1–3° venation strongly developed, 4° and onwards venation indistinct to ± obscure; 1° venation comprising 7–10 veins per side of midrib; tip acute to obtuse; base weakly attenuate to cuneate; margins sinuate to crenulate-dentate, with 12–19 antrorse teeth per side, each tooth up to 0.2 mm long and tipped with an extrafloral nectary; upper leaf surface dark green, glossy, 1° & 2° venation distinct, 3° onwards venation ± obscure, glabrous or with sparse indumentum on veins, soon glabrescent; lower surface pale green, usually drying purple-green or blue-green, 1° & 2° venation well developed and raised, 3° venation distinct but not raised, 4° onwards venation indistinct to ± obscure, glabrous or with scattered to dense indumentum imparting a velutinous texture, minute pocket domatia absent (very rarely one or two per lamina); extrafloral nectaries 2–5 at lamina base, circular, shortly stipitate and glabrous or with scattered indumentum. Inflorescences axillary, up to 90 mm long, usually unisexual, but occasionally with mixed staminate and pistillate flowers; pedunculate up to 15 mm, with scattered to sparse indumentum; bracts triangular-ovate, 0.5–1.4 × 0.4–0.8 mm, glabrous or with scattered indumentum. Staminate flowers 1–6 per glomerule, buds umbonate, apiculate; pedicels filiform, 1.5–4 × 0.4–0.8 mm, glabrous or with scattered to sparse indumentum; sepals (2 or) 3, lanceolate-ovate to ovate, 1.5–3.5 ×

1.4–3 mm, apiculate, glabrous, marginally ciliate or eciliate; receptacle of narrow, erect glands interspersed with stamens, with dense indumentum; stamens 12–40, filaments 1.2–3 × *c.* 0.1 mm, glabrous, anthers 0.4–0.5 × 0.4–0.5 mm. Pistillate flowers held singly, pedicels filiform, 0.5–3 × 0.3–0.8 mm, with scattered indumentum; sepals lanceolate-ovate to orbicular-ovate, 1–2 × 0.5–2 mm, glabrous or with scattered to sparse indumentum; disk annular, 0.2–0.3 mm long, glabrous; ovaries 0.8–1.5 × 1–2 mm, with sparse to dense indumentum; styles subulate, entire, 0.8–1.7 × *c.* 0.1 mm diameter, minutely papillate. Fruits depressed-globose, 3.5–5 × 6–7 mm, green (drying purple-black), with sparse indumentum, suture of adjacent cocci lacking a groove and not prominently ridged. Seeds with an orange to orange-red aril, testa 2.5–3 × 2.5–3 mm, black. *Brittlewood.* **Fig. 2.**

***Additional selected specimens examined*: Queensland.** Port Curtis District: Resumption L.A., S.F. 391 Bulburin, 24°32′S, 151°28′E, Dec 1993, *Forster PIF14534 et al.* (BRI); S.F. 391 Bulburin, Dawes Range road, 24°33′S, 151°29′E, Oct 1999, *Forster PIF24994 & Booth* (A, BRI, L, MEL, QRS); 10 km SSE of Miriamvale, Mt Colosseum N.P., 24°50′S, 151°35′E, Aug 1996, *Thompson MIR286* (BRI). Burnett District: S.F. 695 Kalpowar, Mt Fort William, 4.5 km NE of Kalpowar, 24°39′S, 151°20′E, Jan 2004, *Forster PIF29865 & Tucker* (BRI, L, MEL, NSW); S.F. 695 Kalpowar, 4 km ENE of Kalpowar, 24°41′S, 151°21′E, Jan 2004, *Forster PIF29845 & Tucker* (A, BRI, L, MEL, NSW, Z). Wide Bay District: Great Sandy N.P., Fraser Island, track to Lake Allom, 14 km N of Happy Valley, 25°12′S, 153°12′E, Nov 2002, *Forster PIF29073* & PIF29074** (A, BRI, L, MEL, NSW); Fairlies Knob area, Doongul L.A., S.F. 1294, 25°29′S, 152°17′E, Dec 1992, *Forster PIF12582 & Smyrell* (BRI, MEL, QRS); Oakview, S.F. 220 Malmaison, 13 km ESE of Kilkivan, 26°09′S, 152°19′E, Jan 2003, *Forster PIF29127* (A, L, MEL, NE, NSW). Moreton District: Conondales N.P., start of Peters Fire track, 26°42′S, 152°33′E, Jan 2003, *Forster PIF29220*[+] (A, BRI, L, MEL, NE, NSW); Splityard Creek, Wivenhoe Dam, 27°23′S, 152°38′E, Nov 1990, *Forster PIF7598 et al.* (BRI, K, L, MEL, QRS); S.F. 809, Laceys Creek, D'Aguilar Range, 27°12′S, 152°41′E, Oct 1993, *Forster PIF13987* (A, BRI, K, L, MEL, QRS); Mt Lindesay, 28°20′S, 152°43′E, Nov 1990, *Forster PIF7568 & Orford** (BRI, K, L, MEL, QRS). Darling Downs District: The Head, Main Range N.P., 28°15′S, 152°28′E, Jan 2002, *Forster PIF28072* & Leiper* (A, BRI, L, MEL, NSW); Spring Creek road, 10 km ENE of Killarney, 28°17′S, 152°24′E, Jan 2002, *Forster PIF28076 & Leiper** (A, BRI, L, MEL, NSW). **New South Wales.** Bushrangers Cave track, west of Numinbah Border Gate, Sep 1993, *Forster PIF13864 & Leiper** (A, BRI, K, L, MEL, NSW, QRS); Currowan S.F., 20 km NW of Batemans Bay, 35°32′S, 150°02′E, Dec 1973, *Pullen 8725 & Story** (BRI, CANB); Williams River Valley near Barrington Guest House, N of Singleton, *Pullen 3746** (BRI, CANB, MEL); Wadbilliga N.P., *c.* 0.3 km up unnamed SE running tributary of Brogo River, *Slee 3165** (CANB); Leebold Hill road, Cambewarra Range, NW of Nowra, 34°47′S, 150°33′E, Dec 2000, *Bean 17164** (BRI, NSW); Jervis Bay N.P., 50 m N of 'Lumeah', 35°10′S, 150°35′E, Oct 1996, *Taws 633** (BRI, CANB, NSW). *glabrous variants, [+]intermediate indumentum variants

***Distribution and habitat*:** *Claoxylon australe* is endemic to Australia in subcoastal south-eastern Queensland and eastern New South Wales where it has been recorded from at least twenty-three 1° grid squares (**Map 1**). The most northern locality is from Bulburin Forest Reserve (24°S) and the most southern from Bermagui (37°S). Plants grow in simple to complex microphyll to notophyll vineforests, in the understorey of open forests dominated by eucalypts, or in ecotonal areas, on a variety of substrates, at altitudes between 80 and 1100 m.

***Notes*:** There appears to be strong clinal variation in indumentum cover on the lower leaf laminae and branchlets in this species. Populations at the northern end of the range, particularly those in drier vineforests have densely pubescent foliage with divaricate indumentum. Most collections from higher altitudes in Queensland and New South Wales, or from 'wet' localities such as Fraser Island are glabrous or nearly so. There is an irregular geographical zone of intermediates in southern Queensland at localities such as Buderim Mt (*Forster PIF25975* (BRI)), Tambourine Mt (*Clemens s.n.* [AQ201870]; *Franks AJF9509001*; *White 12725* (all BRI)), near Marburg (*Forster PIF1677* (BRI)), Mt Glorious (*Cribb s.n.* (BRI [AQ478476])) and the Conondales (*Forster PIF28101* (A, BRI, MEL); *Forster PIF29220* (A, BRI, L, MEL, NE, NSW)). The lack of a clear morphological break in this character state negates any move to recognise the pubescent variant as a discrete subspecific taxon which is a prerequisite if the subspecific concept of Stebbins (1950) or Stace (1989) is to be adhered to. There is also considerable variation in the leaf lamina marginal toothing, but this does not seem to be correlated geographically or ecologically, hence there is little purpose in recognising Bentham's varieties.

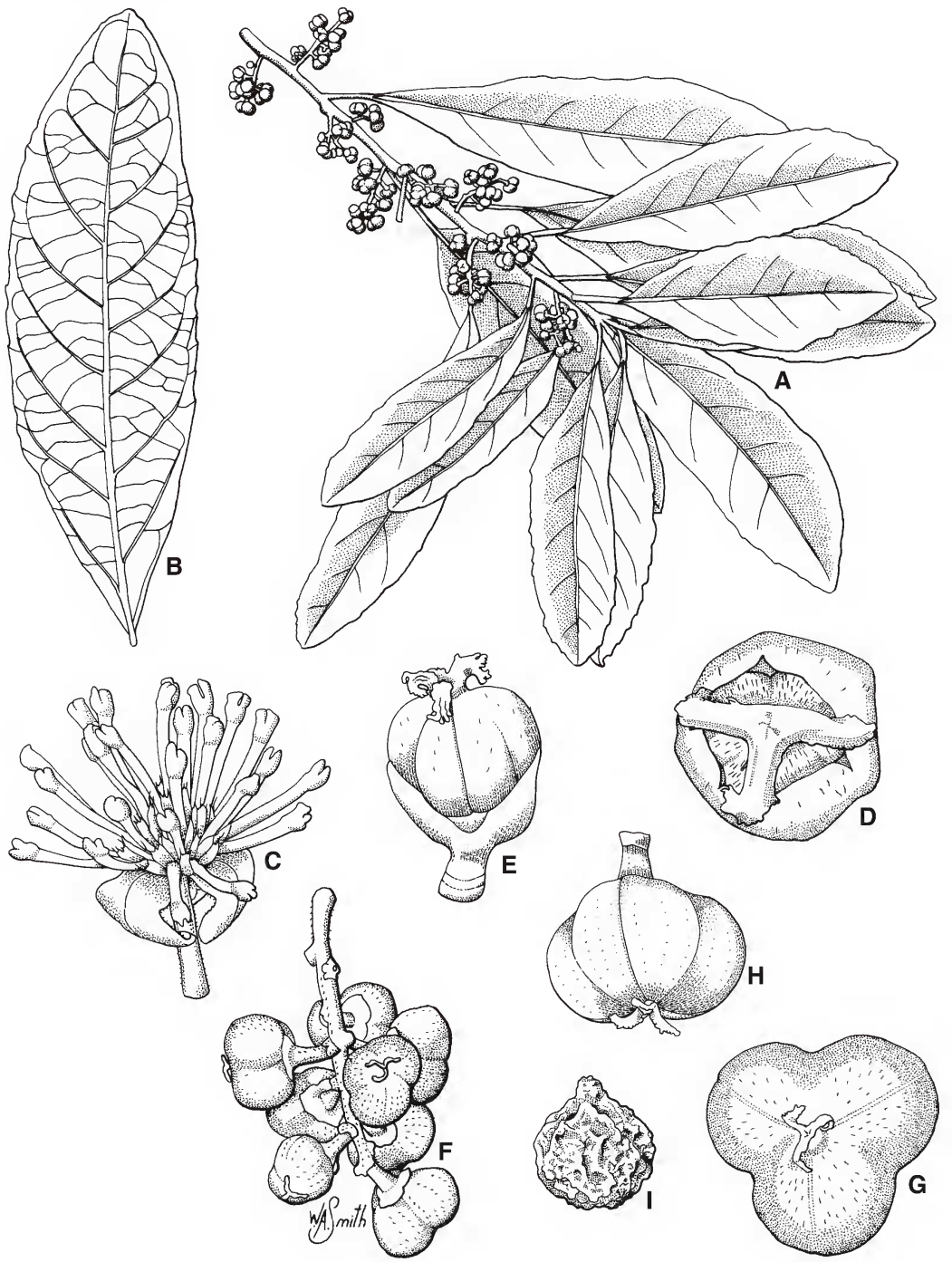

Fig. 2. ***Claoxylon australe.*** A. fruiting branchlet × 0.4. B. leaf viewed from below and showing 1°–3° venation × 0.6. C. lateral view of male flower × 8. D. face view of female flower × 12. E. lateral view of female flower × 8. F. partial inflorescence with fruit × 2. G. face view of fruit × 6. H. lateral view of fruit × 4. I. seed with aril removed × 8. A, B, D, F, G, I from *Forster PIF32433* (BRI); C from *Forster PIF12582* (BRI); E from *Forster PIF7598* (BRI); H from *Forster PIF4882* (BRI). Del. W. Smith.

Claoxylon australe is sometimes confused with *C. tenerifolium*, a situation that is not helped with vague diagnostic descriptions in some field guides (e.g. Harden *et al.* 2006). The fruit are green when ripe, but dry purple-black. Some field guides list the fruit as purple-black (e.g. Harden *et al.* 2006), but this must have been based on examination of dried material rather than fresh material.

***Phenology*:** Flowers August to January, with occasional occurrences in other months. Fruits from November to May.

***Conservation status*:** This species is very widespread and not threatened. It is present in Jervis Bay National Park in the A.C.T., Border Ranges, Dorrigo, Gilbralter Range, Guy Fawkes River, Mimosa Rocks, Mt Warning, Myall Lakes, Wadbilliga, Washpool and Woko National Parks in New South Wales (BRI records; Floyd 1989) and Boat Mountain, Bunya Mountains, Burleigh Head, Conondales, Cressbrook, Great Sandy, Kondalilla, Main Range, Mapleton Falls, Mt Barney, Mt Bauple, Mt Colosseum, Mt Dumeresq, Mt Eerwah, Mt French, Mt Glorious, Mt Mistake, Mt Pinbarren, Wilkie Scrub and Witches Falls National and Conservation Parks in Queensland (BRI records; Forster *et al.* 1991). Present in State Forests 50, 54, 74, 82, 95, 124, 151, 154, 220, 256, 274, 283, 287, 289, 298, 301, 309, 316, 379, 391, 632, 648, 673, 788, 809, 893, 1294, 1344 in Queensland (BRI records; Forster *et al.* 1991) and Bellangry, Clouds Creek, Conglomerate, Currowan, Doyles River, Kangaroo River, Marengo, Moonpar, Mt Pikapene, Oakes, Pine Creek, Toonumbar, Unumgar, Way Way, Whian Whian, Wild Cattle Creek and Yabbra State Forests in New South Wales (BRI records; Floyd 1989).

***Etymology*:** The specific epithet is from the Latin adjective *australis* (south, southern) and refers to this species being the most southerly occurring in Baillon's day, as indeed it is still today.

3. Claoxylon hillii Benth., *Fl. Austral.* 6: 131 (1873). **Type:** Queensland. Cook District: Albany Island, Cape York, *W.Hill 4* (lecto: K *n.v.*, photo at BRI!; *fide* Airy Shaw (1976: 391)).

Claoxylon indicum var. *novoguineense* J.J.Sm., *Meded. Depart. Landb. Ned.-Indië* 10: 26 (1907). **Type:** Indonesia, Papua, Merauke, 1904, *Koch 25* (holo: BO *n.v.*).

Claoxylon delicatum Airy Shaw, *Kew Bull.* 20: 32 (1966). **Type:** Papua New Guinea, Peria Creek, 20 August 1953, *L.J.Brass 24082* (holo: K *n.v.*, photo at BRI!; iso: CANB).

***Illustrations*:** Wheeler (1992: 595, fig. 181E [as *C. tenerifolium*]); Dick (1994: 264 [as *C. tenerifolium*]); Dunlop *et al.* (1995: 211 [as *C. tenerifolium*]); Cooper & Cooper (2004: 176).

Small tree to 15 m high, evergreen, usually dioecious, rarely monoecious. Indumentum of simple trichomes, generally antrorse, clear to straw. Stems rounded, 3–5 mm diameter in leaf bearing branchlets, cream, lenticellate, with dense indumentum when young, glabrescent. Stipules small, acute to subulate, 0.7–1 × 0.2–0.4 mm, glabrous. Leaves: petioles 30–125 × 1.5–2 mm, grooved on top, glabrous; laminae elliptic, obovate or ovate, coriaceous, 95–300 × 40–145 mm, discolorous, 1–3° venation strongly developed, 4° and 5 venation distinct; 1° venation comprising 6–8 veins per side of midrib; tip acute to shortly acuminate, rarely obtuse; base cuneate to rounded; margins sinuate to crenulate-dentate, with 13–40 antrorse teeth per side, each tooth up to 2 mm long and tipped with an extrafloral nectary; upper leaf surface dark green, glossy, 1–3° venation distinct, 4° onwards venation ± obscure, glabrous or with scattered to sparse indumentum on veins, soon glabrescent; lower surface pale green, usually drying dull green or purple-green, 1–5° venation well developed, 1–3° raised, 4° and 5° venation distinct but not raised, glabrous or with scattered to dense indumentum primarily on the 1° and 2° venation, minute pocket domatia between 1° and 2° junctions, particularly towards the lamina base; extrafloral nectaries 1 or 2 at lamina base, subulate, with dense indumentum at base. Inflorescences axillary, up to 180 mm long, usually unisexual, but occasionally with mixed staminate and pistillate flowers; pedunculate up to 17 mm, with sparse to dense indumentum; bracts acuminate to lanceolate, 0.4–1 × 0.3–0.7 mm, with dense indumentum.

Staminate flowers 10–15 per glomerule, buds umbonate, apiculate; pedicels filiform, 1–2.5 × *c.* 0.2 mm, with dense indumentum; sepals 3, lanceolate-ovate, 1.5–1.8 × *c.* 0.8 mm, with dense indumentum; receptacle of narrow, erect glands interspersed with stamens, topped with tufts of trichomes, otherwise glabrous; stamens 16–24, filaments 0.8–1.2 × *c.* 0.1 mm, mainly glabrous apart from dense indumentum at base, anthers 0.3–0.4 × 0.3–0.4 mm. Pistillate flowers held singly or paired, rarely as single flower in male dominated glomerule, pedicels filiform, 1–4 × 0.5–1 mm, with dense indumentum; sepals 3, lanceolate-ovate, 1.8–2.5 × 1.1–1.7 mm, with dense indumentum; disk annular, *c.* 0.5 mm long, somewhat lacerate; styles subulate, 0.7–1 × *c.* 0.1 mm, minutely papillate; ovaries 1.2–2 × 1.2–2 mm, with dense indumentum. Fruits depressed-globose, 6–8 × 3.5–4 mm, green (drying grey-green), with dense indumentum, suture of adjacent cocci prominently ridged. Seeds with an orange-red aril, testa verrucose, *c.* 3 × 3 mm, black. **Fig. 3.**

***Additional selected specimens examined*: Western Australia.** Mitchell Plateau, Lone Dingo, Feb 1979, *Beard 8481* (PERTH). **Northern Territory.** Mt Brockman, Radon Gorge, 12°45′S, 132°54′E, Apr 1980, *Dunlop 5451* (BRI, CANB, DNA, MEL); Grant Island, 11°09′S, 132°52′E, May 1992, *Dunlop 8972* (DNA, MEL); Oxley Island, 10°59′S, 132°49′E, Jul 1992, *Leach 3155* (BRI, DNA); 5 km E of mouth of Peter John River, NE Arnhem Land, 12°15′S, 136°25′E, Feb 1988, *Russell-Smith 4771 & Lucas* (BRI, CANB, DNA, NSW); Conder Point, Melville Island, 11°44′S, 131°17′E, May 1989, *Russell-Smith 8066 & Lucas* (BRI, DNA, PERTH); NE Arnhem Land, Dhalanbuy, 12°15′S, 136°25′E, Feb 1988, *Weightman 4176* (BRI, CANB, DNA). **Queensland.** Cook District: Gabba Island, Torres Strait, 9°45′S, 142°38′E, Jun 2001, *Waterhouse BMW6265* (BRI); Warraba (formerly Sue) Island, Torres Strait, 9°55′S, 142°46′E, Jun 1995, *Waterhouse BMW3669* (BRI, MBA); Albany Island, 10°43′S, 142°35′E, May 1995, *Le Cussan 444* (BRI); Thursday Island, Jun 1897, *Bailey 110* (BRI); Stoney Point, 12°25′S, 143°16′E, Nov 1977, *Tracey 14091* (BRI); opposite the 'Green House', near ranger station, Iron Range, 12°45′S, 143°17′E, Dec 2000, *Legge 20* (BRI, MEL); Iron Range, near King Park, 12°45′S, 143°17′E, Oct 2001, *Legge 30* (BRI); Cairns, suburb of Smithfield, James Cook University Campus, 16°49′S, 145°41′E, Nov 2006, *Forster PIF32314* (BRI, MEL); Currunda Creek, Redlynch, 7 km W of Cairns, 16°55′S, 145°40′E, Dec 2003, *Forster PIF29783 & Jensen* (A, BRI, L, MEL, NSW); Behana Creek (Tringilburra Creek), Bellenden Ker, Jun 1889, *Bailey s.n.* (BRI [AQ201884]); S.F. 310, 10.5 km along Goldsborough road, 17°12′S, 145°45′E, Dec 1993, *Forster PIF14454* (A, BRI, MEL, QRS); McDonnell Creek, behind school, 17°12′S, 145°53′E, Dec 1993, *Forster PIF14450* (A, BRI, K, L, MEL, QRS); Broton Hill, Clump Point N.P., 17°50′S, 146°06′E, Nov 1991, *Halford Q723* (BRI, QRS).

***Distribution and habitat*:** *Claoxylon hillii* is the only non-endemic species of this genus in Australia, as it also occurs in southern New Guinea in both Papua New Guinea and Papua. In Australia it is widespread on northern Cape York Peninsula in Queensland, the 'top end' of the Northern Territory, and the Kimberley of Western Australia. It has been recorded in at least twenty 1° grid cells (**Map 2**). Plants grow in semi-deciduous to deciduous vinethickets and vineforests on a variety of substrates, at altitudes from sea level to 300 m.

***Notes*:** *Claoxylon hillii* was described by Bentham (1873) and subsequently recognised by Bailey (1901), but was reduced to synonymy under *C. tenerifolium,* together with *C. indicum* var. *novoguineense* J.J.Sm. and *C. delicatum* Airy Shaw by Airy Shaw (1976) and this position was subsequently upheld by him (Airy Shaw 1980a,b, 1981). As a result *Claoxylon hillii* has not been recognised in recent local floras or checklists for the regions where it occurs (Wheeler 1992; Dunlop *et al.* 1995; Forster & Henderson 1997; Govaerts *et al.* 2000; Forster & Halford 2002). *Claoxylon hillii* is easily discernible from *C. tenerifolium* in the leaf laminae below with minute pocket domatia between the 1° and 2° veins (versus absent), the subulate extrafloral nectaries (versus stipitate, circular), the greater number of male flowers per glomerule and the densely hairy fruit with marked ridging on the suture between cocci (versus scattered indumentum and no ridging). *Claoxylon hillii* is also a larger growing plant that tends to have thicker branchlets, larger leaves with a greater number of marginal teeth and longer petioles and longer inflorescences.

Claoxylon hillii is superficially similar to *C. indicum*; however, the latter species is easily distinguished by the presence of dense indumentum on the leaf laminae imparting a velutinous quality to the touch.

***Phenology*:** Flowering mainly occurs between September and February, although there are records from June. Fruiting occurs one to two months later.

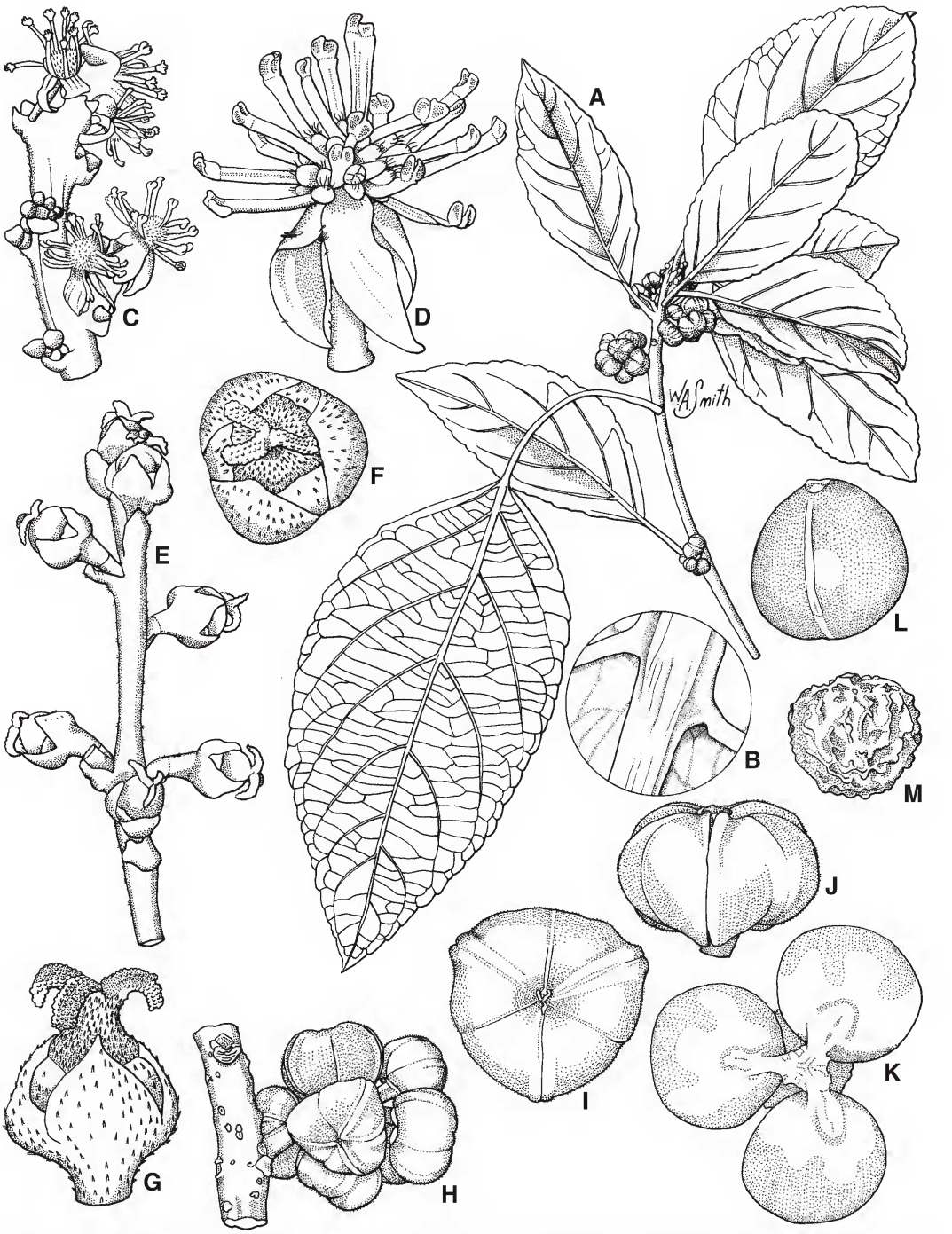

Fig. 3. ***Claoxylon hillii***. A. fruiting branchlet, with one leaf viewed from below and showing 1°–3° venation × 0.4. B. axils of 1° and 2° veins showing poorly formed domatia × 6. C. part of inflorescence with glomerules of male flowers × 3. D. lateral view of male flower × 8. E. part of inflorescence with female flowers × 3. F. face view of female flower × 12. G. lateral view of female flower × 12. H. inflorescence with fruit × 1.5. I. face view of fruit × 3. J. lateral view of fruit × 3. K. face view of fruit with three seeds (arils intact) attached to central columella × 6. L. seed with aril intact × 6. M. seed with aril removed × 6. A, F–J from *Forster PIF32314* (BRI); B–C from *Forster PIF29783* (BRI); K–M from *Legge 20* (BRI). Del. W. Smith.

***Conservation status*:** *Claoxylon hillii* is common and widespread in northern, tropical Australia. It is present in Family Islands, Hinchinbrook, Iron Range and Wooroonooran National Parks, Jumrum Conservation Park and Gadgarra Forest Reserve in Queensland and Kakadu National Park in the Northern Territory.

***Etymology*:** Named for Walter Hill (1820–1904), first Colonial Botanist for the colony of Queensland, and collector of the type.

4. Claoxylon tenerifolium (F.Muell. ex Baill.) F.Muell., *Fragm.* 6: 183 (1868); *Mercurialis tenerifolia* F.Muell. ex Baill., *Adansonia* 6: 323 (1866). **Type:** Queensland. [Port Curtis District:] Rockhampton, Thozet Creek, January 1863, *Dallachy 137* (lecto [here designated]: P *n.v.*, photo at BRI!; isolecto: MEL).

Shrub or small tree to 8 m high, deciduous or evergreen, usually dioecious, rarely monoecious. Indumentum of simple trichomes, generally antrorse, clear to straw. Stems rounded, 2–4 mm diameter in leaf bearing branchlets, cream to grey-yellow, lenticellate, with scattered indumentum when young, glabrescent. Stipules small, acuminate, 0.2–0.7 × 0.1–0.3 mm, with dense indumentum. Leaves: petioles 5–50 × 0.3–1.5 mm, grooved on top, with scattered to dense indumentum; laminae elliptic, obovate or oblanceolate, chartaceous, 18–155 × 8–155 mm, discolorous, 1–3° venation strongly developed, 4° and onwards venation distinct to ± obscure; 1° venation comprising 4–11 veins per side of midrib; tip acute to shortly acuminate; base attenuate to cuneate; margins sinuate to crenulate-dentate, with 8–19 antrorse teeth per side, each tooth up to 2 mm long and tipped with an extrafloral nectary; upper leaf surface dark green, glossy, 1° & 2° venation distinct, 3° onwards venation ± obscure, glabrous or with scattered to sparse indumentum on veins, soon glabrescent; lower surface pale green, usually drying purple-green or blue-green, 1° & 2° venation well developed and raised, 3° venation distinct but not raised, 4° venation distinct to ± indistinct, 5° venation obscure, glabrous or with scattered indumentum primarily on the 1° venation (sometimes on interveinal areas), minute pocket domatia absent; extrafloral nectaries 2 at lamina base, circular, shortly stipitate, with dense indumentum. Inflorescences axillary, up to 130 mm long, usually unisexual, but occasionally with mixed staminate and pistillate flowers; pedunculate up to 10 mm, with scattered to dense indumentum; bracts lanceolate to lanceolate-ovate, 0.8–1.8 × 0.2–0.6 mm, with dense indumentum. Staminate flowers 1–6 per glomerule, buds umbonate, apiculate, pedicels filiform, 0.8–3 × 0.1–0.3 mm, glabrous or with scattered to dense indumentum; sepals 3, lanceolate-ovate, 1.8–2 × 0.7–1.8 mm, glabrous or with scattered indumentum; receptacle of narrow, erect glands interspersed with stamens, glabrous or topped with tufts of trichomes; stamens 10–20, filaments 0.8–1.8 × *c.* 0.1 mm, glabrous, anthers 0.3–0.4 × 0.3–0.4 mm. Pistillate flowers held singly (rarely as single flower in male dominated glomerule), pedicels filiform, 0.5–1.4 × 0.1–0.6 mm, with scattered to dense indumentum; sepals lanceolate-ovate, 0.8–1.2 × 0.5–1 mm, glabrous or with dense indumentum, ciliate on margins; disk annular, 0.3–0.5 mm long, glabrous; styles weakly flabellate, 0.4–0.9 × 0.1–0.3 mm, minutely papillate; ovaries 0.8–1.2 × 0.8–1.2 mm, glabrous or with scattered to dense indumentum. Fruits depressed-globose, 5–7 × 3–4 mm, green-yellow to orange (drying purple-black), glabrous or with scattered indumentum, suture of adjacent cocci lacking a groove and not prominently ridged. Seeds with an orange to orange-red aril, testa verrucose, 2–3 × 2–3 mm, black. *Queensland brittlewood.*

***Notes*:** Baillon (1866) described *Mercurialis tenerifolia* (based on an epithet of Mueller's) citing two syntypes, one collected by Dallachy and the other by Bowman. The better preserved of these two collections is the Dallachy one and it is selected as lectotype of the name.

With the exclusion of *Claoxylon hillii* from synonymy, *C. tenerifolium* remains a variable taxon and two subspecies are recognized here. The nominate subspecies occurs in 'dry rainforest' (vineforests, vinethickets at altitudes below 900 m) in the south of the

species range, whereas the newly described subsp. *boreale* occurs in 'wet rainforest' (vineforests at altitudes above 200 m) in the north of the range. The two subspecies differ primarily in indumentum cover and the dimensions of a number of floral parts. I have not discerned intermediate populations between the two subspecies; however, as the differences are minor, specific rank is not justified. *Claoxylon tenerifolium* subsp. *boreale* also tends to have much glossier foliage in the fresh state than subsp. *tenerifolium*; however, both subspecies have glossy leaves and the glossiness is probably due to local climatic conditions.

***Etymology*:** The specific epithet is derived from the Latin *tener* (tender, delicate) and *–folius* (leaved).

Key to subspecies of *Claoxylon tenerifolium*

Plants evergreen; stipules 0.6–0.7 × *c.* 0.3 mm; male flowers 1–3 per glomerule, pedicels 2.2–3 × 0.2–0.3 mm, with dense indumentum; receptacle glands topped with tufts of trichomes, otherwise glabrous; female flowers with pedicels 0.8–2.2 × 0.4–0.6 mm, with dense indumentum, sepals and ovaries with dense indumentum; Wet Tropics of Queensland . . . . . **subsp. *boreale***

Plants evergreen to deciduous; stipules *c.* 0.2 × 0.1 mm; male flowers 1–6 per glomerule, pedicels 0.8–2.5 × *c.* 0.1 mm, glabrous or with scattered indumentum; receptacle glands glabrous; female flowers with pedicels 0.5–1.4 × 0.1–0.2 mm, with scattered to sparse indumentum, sepals glabrous, ovaries glabrous or with scattered indumentum near base; Queensland, mainly south of the Wet Tropics . . . . . **subsp. *tenerifolium***

4a. *Claoxylon tenerifolium* subsp. ***tenerifolium***

Claoxylon australe var. *latifolia* Benth., *Fl. Austral.* 6: 131 (1873). **Type:** Queensland. [Port Curtis District:] Rockhampton, *O'Shanesy s.n.* (holo: K *n.v.*, photo at BRI!).

***Illustrations*:** Williams (1999: 115); Harden *et al.* (2006: 109).

Evergreen to deciduous shrub or small tree to 6 m tall. Stipules *c.* 0.2 × 0.1 mm. Leaf petioles 5–50 × 0.3–1.5 mm, with scattered indumentum. Inflorescences up to 80 mm long. Staminate flowers 1–6 per glomerule, pedicels 0.8–2.5 × *c.* 0.1 mm, glabrous or with scattered indumentum; receptacle glands glabrous. Pistillate flowers with pedicels 0.5–1.4 × 0.1–0.2 mm, with scattered to sparse indumentum; sepals glabrous; ovaries glabrous or with scattered indumentum near base, rarely near apex; styles 0.4–0.5 × *c.* 0.1 mm. Fruits 6–7 × 3.5–4 mm. Seeds 2.5–3 × 2.5–3 mm. **Fig. 4.**

***Additional selected specimens examined*: Queensland.** North Kennedy District: 40 Mile Scrub, 18°05′S, 144°49′E, Jan 2005, *Sankowsky 2579 & Sankowsky* (BRI); Mingela Bluff, 19°53′S, 146°45′E, Jan 1992, *Forster PIF9425 & Bean* (BRI, K, MEL, QRS); Mt Abbot, 50 km W of Bowen, 20°06′S, 147°46′E, Oct 1992, *Bean 5178* (BRI); 14 km E of Mt Cooper Homestead, 20°31′S, 146°55′E, Jun 1992, *Thompson GHA45 & Sharpe* (BRI). South Kennedy District: Carlisle Island, 35 km N of Mackay, 20°47′S, 149°17′E, Dec 1986, *Sharpe 4600* (BRI); 9 km W of Cathu, Cathu S.F., 20°48′S, 148°33′E, Dec 1991, *Halford Q825* (BRI); Hazlewood Gorge, SSW of Eungella, 21°15′S, 148°27′E, Jan 1993, *Forster PIF12722* (BRI). Leichhardt District: 'Clive', 22°47′S, 149°24′E, Mar 1993, *Fensham 740* (BRI); 26 km NE of Taroom, Mt Rose Station, 25°27′S, 149°58′E, Nov 1996, *Halford Q3197* (BRI). Port Curtis District: S.F. 114, 65 km NW of Rockhampton, 23°06′S, 150°01′E, Dec 1998, *Batianoff GNB981238 et al.* (AD, BRI, DNA, NSW); Dan Dan Scrub, S.F. 53, 24°10′S, 151°04′E, Dec 1987, *Gibson 1054* (BRI); S.F. 583 Wietalaba, 24°17′S, 151°12′E, Dec 1995, *Forster PIF18271* (BRI); Deepwater N.P., 40 km E of Miriam Vale, 24°21′S, 151°58′E, Dec 1990,

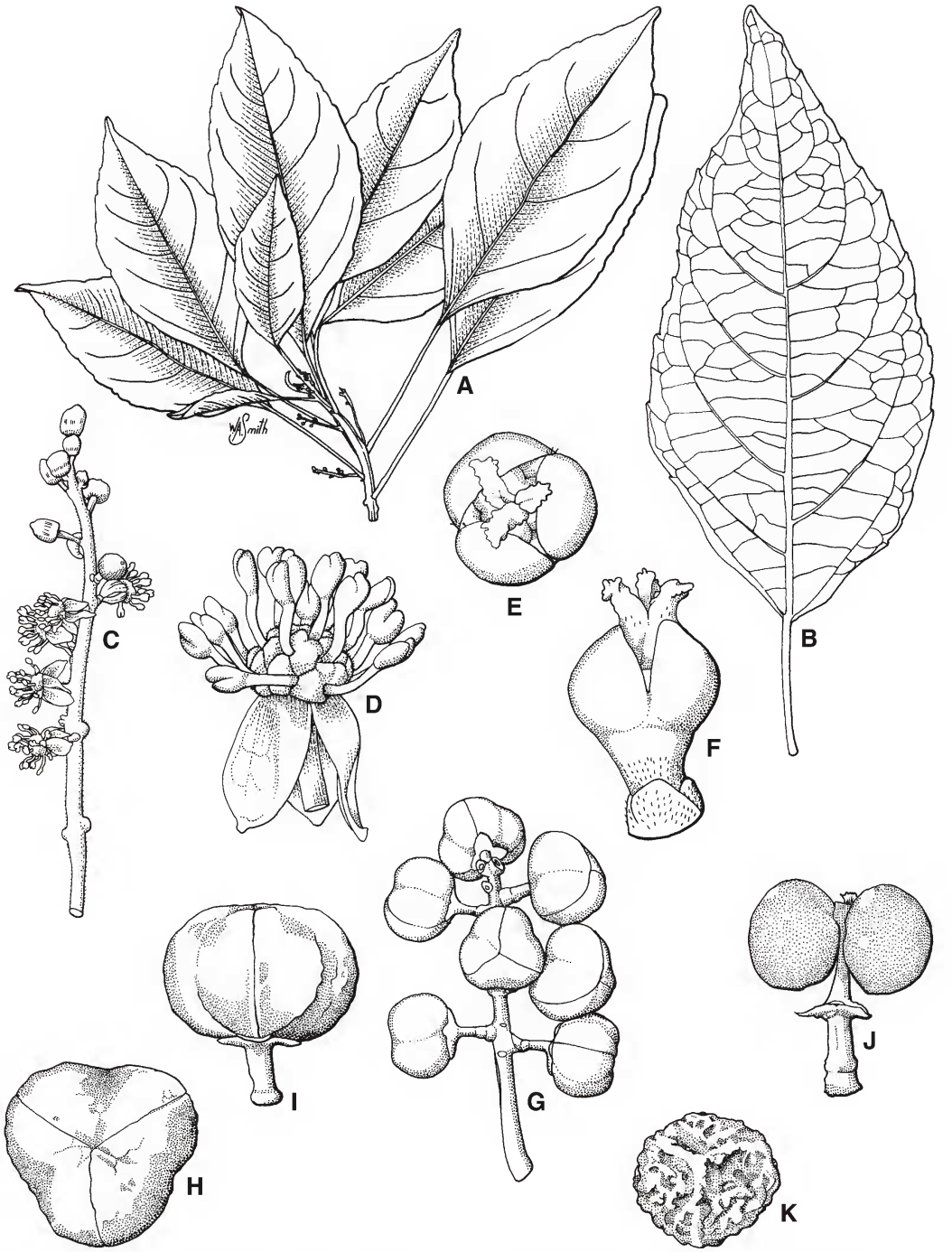

Fig. 4. ***Claoxylon tenerifolium*** **subsp.** ***tenerifolium***. A. flowering branchlet × 0.4. B. leaf viewed from below showing 1°–3° venation × 1. C. part of inflorescence with glomerules of male flowers × 2. D. lateral view of male flower × 8. E. face view of female flower × 12. F. lateral view of female flower × 12. G. part of inflorescence with fruit × 2. H. face view of fruit × 4. I. lateral view of fruit × 4. J. dehisced fruit with two seeds in situ with arils intact × 4. K. seed with aril removed × 8. A from *Forster PIF6187* (BRI); B, H–J from *Forster PIF29900* (BRI); C & D from *Forster PIF12585* (BRI); E & F from *Forster PIF12591* (BRI). Del. W. Smith.

Gibson TOI81 (BRI). Burnett District: Goodnight Scrub National Park, 25°17′S, 151°52′E, Jan 2004, *Forster PIF29900 & Tucker* (A, BRI, L, MEL, MO, NSW, Z); 3.5 km SSE of Binjour, 25°33′S, 151°28′E, Jan 1990, *Forster PIF6187* (BISH, BRI, DNA, MEL, MO, QRS); Coast Range, Coongara Creek, 19 km SSW of Biggenden, 25°14′S, 151°59′E, Nov 1993, *Telford 11961* (BRI, CANB). Wide Bay District: Mt Gaeta, *c.* 36 km N of Mt Perry township, 24°50′S, 151°35′E, Oct 1993, *Forster PIF14166* (BRI); Fairlies Knob area, Doongul L.A., S.F. 1294 Warrah, 25°29′S, 152°17′E, Dec 1992, *Forster PIF12585 & Smyrell* (BRI, QRS); Utopia, 14 km SSE of Biggenden, 25°38′S, 152°05′E, Dec 1991, *Forster PIF9224 & Smyrell* (A, BRI, K, L, MEL, QRS); S.F. 420, 25°55′S, 152°23′E, Nov 1988, *Forster PIF4843* (BRI, NSW).

***Distribution and habitat*:** *Claoxylon tenerifolium* subsp. *tenerifolium* occurs in eastern subcoastal Queensland from Forty Mile Scrub N.P. in the north (18°05′S) to State Forest 420 in the south (25°54′S) and has been recorded from at least nineteen 1° grid squares (**Map 3**). Plants grow in 'dry rainforests' (simple to complex microphyll and notophyll vineforests and vinethickets) on a variety of soils derived from basalts, granites and sandstones at altitudes from near sealevel to 900 m (the latter in inland locations such as the Central Highlands).

***Notes*:** Both *Claxylon australe* and *C. tenerifolium* subsp. *tenerifolium* may be sympatric where the ranges of the two intersect (e.g. *Forster PIF12585 & PIF12582*) but no hybrids have been observed.

The fruits are yellow-green to orange when ripe, but dry purple-black. Some field guides list the fruit as purple-black (e.g. Harden *et al.* 2006), but this must have been based on examination of dried collections rather than fresh material.

***Phenology*:** Flowers and fruits throughout the year, although the main flowering period is from October to December.

***Conservation status*:** *Claoxylon tenerifolium* subsp. *tenerifolium* is common and widespread. It has been recorded from Forty Mile Scrub, Deep Water, Goodnight Scrub, Mt Walsh and Palmgrove National Parks and State Forests 42, 53, 310, 391, 420, 1229, 1294 (BRI records; Forster *et al.* 1991).

4b. Claoxylon tenerifolium subsp. **boreale** P.I.Forst., **subspecies nova**, a *C. tenerifolio* subsp. *tenerifolio* stipulis grandioribus (0.6–0.7 × *c.* 3 mm in vicem 0.2 × *c.* 0.1 mm), floribus masculis in quoque glomerulo paucioribus (1–3 in vicem 1–6), in pedicellis crassis (2.2–3 × 0.2–0.3 mm in vicem 0.8–2.5 × *c.* 0.1 mm) dispositis, indumento denso (in vicem dispersi usque sparsi), summis glandulis receptaculi crinibus trichomatum ornatis, cetera glabris (in vicem glaberrimorum), floribus femineis in pedicellis crassis (2.2 × 0.4–0.6 mm in vicem 0.5–1.4 × 0.1–0.2 mm) dispositis, indumento denso (in vicem dispersi usque sparsi), sepalis ovariisque indumento denso (in vicem dispersi vel carentis) praeditis differt. **Typus:** Queensland. Cook District: State Forest 143, South Mary Logging Area, 21 km along Mt Lewis road, 16°32′S, 145°16′E, 1 November 2001, *P.I.Forster PIF27700*, *R.Booth & R.Jensen* (holo: BRI [2 sheets & spirit]; iso: A, BISH, DNA, L, MEL, MO, NSW, Z).

Evergreen shrub or small tree to 8 m tall. Stipules 0.6–0.7 × *c.* 0.3 mm. Leaf petioles 13–38 × 0.8–1 mm, with scattered to dense indumentum. Inflorescences up to 130 mm long. Staminate flowers 1–3 per glomerule, pedicels 2.2–3 × 0.2–0.3 mm, with dense indumentum; receptacle glands topped with tufts of trichomes, otherwise glabrous. Pistillate flowers with pedicels 0.8–2.2 × 0.4–0.6 mm, with dense indumentum; ovaries with dense indumentum; styles 0.5–0.9 × 0.2–0.3 mm. Fruits 5–6 × 3–4 mm. Seeds 2–2.2 × 2–2.8 mm. **Fig. 5.**

***Additional selected specimens examined*: Queensland.** Cook District: T.R. 55, Whyanbeel, 16°20′S, 145°20′E, Oct 1974, *Hyland 7743* (BRI, QRS); S.F. 143, North Mary L.A., 16°30′S, 145°16′E, Nov 1995, *Forster PIF18120 et al.* (BRI); Mt Lewis road, 26 km from junction with Mareeba – Mossman road, 16°31′S, 145°16′E, Oct 1987, *Foreman 1871* (BRI, CANB, MEL, NSW, QRS); S.F. 143, North Mary L.A., 29 km along Mt Lewis road near hut, 16°31′S, 145°16′E, Jul 1994, *Forster PIF15635 et al.* (BRI, QRS); S.F. 143, South Mary L.A., 21 km along Mt Lewis road, 16°32′S, 145°16′E, Nov 2001, *Forster PIF27699 et al.* (A, BISH, BRI, DNA, L, MEL, MO, NSW, Z); Mt Lewis, just beyond North Mary Creek, 16°33′S, 145°17′E, Nov 1998, *Jensen 939* (BRI, QRS); S.F. 42 Mowbray, Rex Range, 16°32′S, 145°22′E, Dec 2001, *Forster PIF27909 et al.* (A, BISH, BRI, L, MEL, MO, NSW, NY, Z); S.F. 1229 Kuranda, 14 km along Black Mt road from Kuranda road, 16°45′S, 145°34′E, Sep 2001, *Forster PIF27529 et al.* (A, BRI, L, MEL, NSW, NY); Black Mt road, N of Kuranda, 16°48′S, 145°38′E,

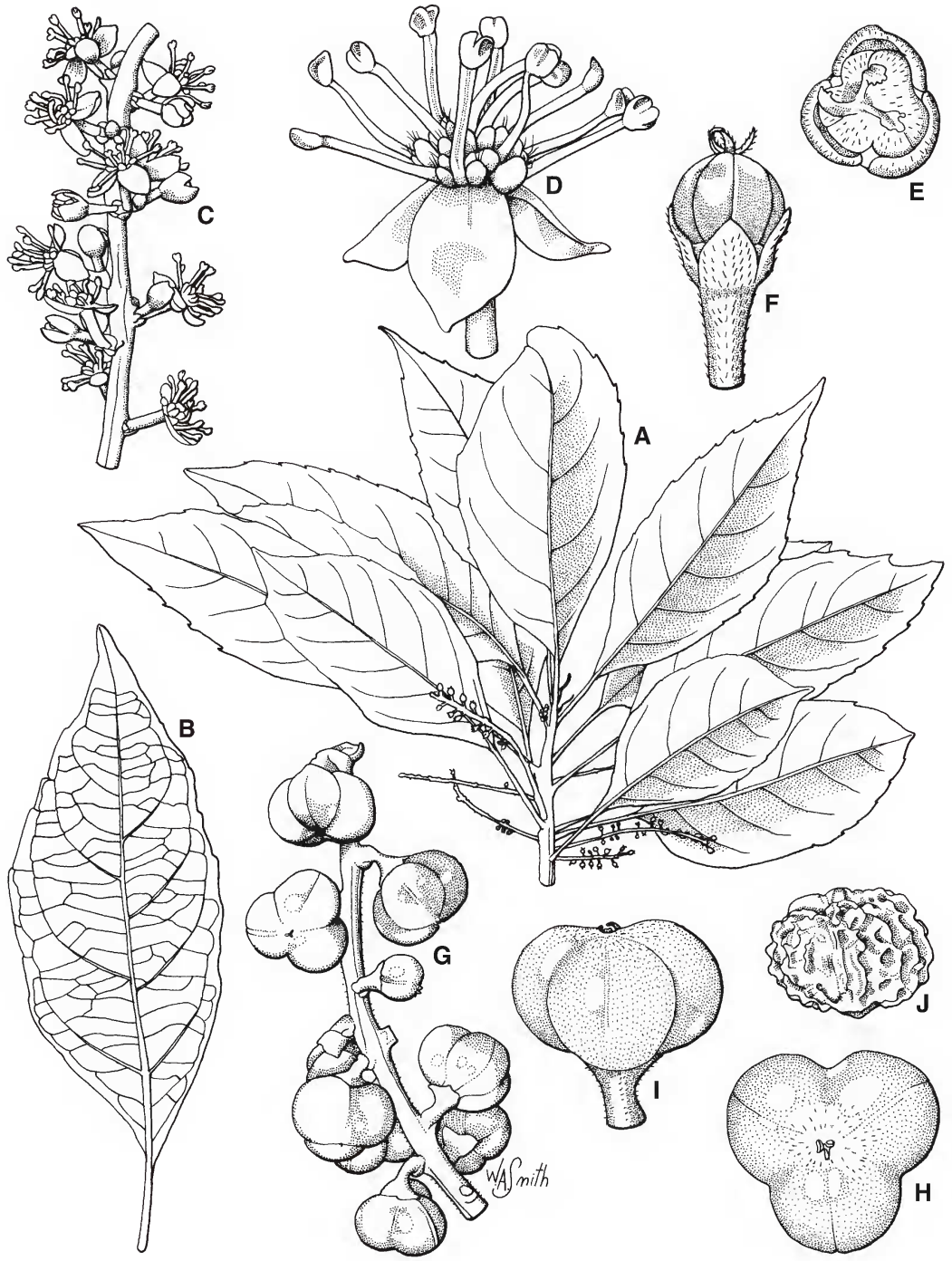

Fig. 5. ***Claoxylon tenerifolium*** **subsp.** ***boreale***. A. flowering branchlet × 0.6. B. leaf viewed from below showing 1°–3° venation × 1. C. part of inflorescence with glomerules of male flowers × 2. D. lateral view of male flower × 8. E. face view of female flower × 12. F. lateral view of female flower × 8. G. part of inflorescence with fruit × 2. H. face view of fruit × 4. I. Lateral view of fruit × 4. J. seed with aril rermoved × 8. A, B, E, F from *Forster PIF27699* (BRI); C & D from *Forster PIF27700* (BRI); G–J from *Forster PIF29767* (BRI). Del. W. Smith.

Dec 2001, *Jago 5819* (BRI); North Bell Peak, summit area, Malbon Thompson Range, 17°05′S, 145°52′E, Nov 1995, *Forster PIF18044 et al.* (BRI); S.F.R. 194, 17°20′S, 145°25′E, Feb 1969, *Hyland 2156* (BRI); Wooroonooran N.P., track to Bartle Frere from west, 17°22′S, 145°45′E, Dec 2003, *Forster PIF29761 & Jensen* (BRI, L); lower slopes of Mt Bartle Frere, 17°22′S, 145°47′E, Dec 1994, *Hunter JHI628* (BRI); Westcott road, Topaz, 17°24′S, 145°42′E, Nov 1995, *Forster PIF18188* (BRI, K, MEL, NSW, QRS); *loc. cit.*, Nov 2002, *Cooper WWC1797, WWC1799* (BRI); *loc. cit.*, Dec 2003, *Forster PIF29767 & Jensen* (A, BRI, L, MEL, NSW).

***Distribution and habitat*:** *Claoxylon tenerifolium* subsp. *boreale* is endemic to the Wet Tropics of north-eastern Queensland and has been recorded from two 1° grid squares (**Map 3**). Plants grow on the margins of 'wet rainforest' (simple to complex notophyll vineforest or microphyll moss/fern thicket) on substrates derived from basalts, granites or metamorphics at altitudes between 200 and 1200 m.

***Notes*:** This subspecies shows some variation in leaf lamina shape and thickness, mainly associated with elevation and exposure. The populations on the Mt Lewis road (altitude above 1000 m) tend to have elliptic laminae that are somewhat thicker, whereas those in more lowland localities (e.g. Black Mt road, Whyanbeel, Rex Range) have obovate to oblanceolate laminae that are thinner. These differences are probably phenotypic; however, transplant experiments are required to determine this.

***Phenology*:** Flowers have been recorded from October to November. Fruiting would be one to two months later.

***Conservation status*:** This subspecies is of sporadic and somewhat restricted distribution. It appears to be a pioneer species that requires areas of disturbance and is often collected on the margins of rainforest or on roadsides through rainforest. It is not considered threatened and is present in the conservation estate at Malbon Thompson, Mowbray and Mt Lewis Forest Reserves and Wooroonooran National Park.

***Etymology*:** The subspecific epithet is based on the Latin word *borealis* (north, northern) and pertains to the distribution of the taxon.

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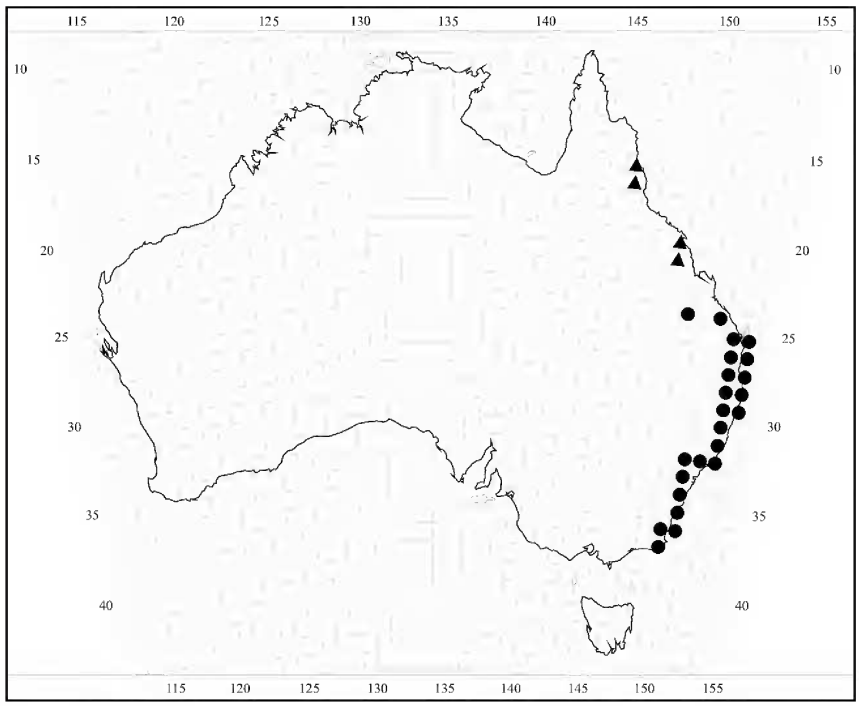
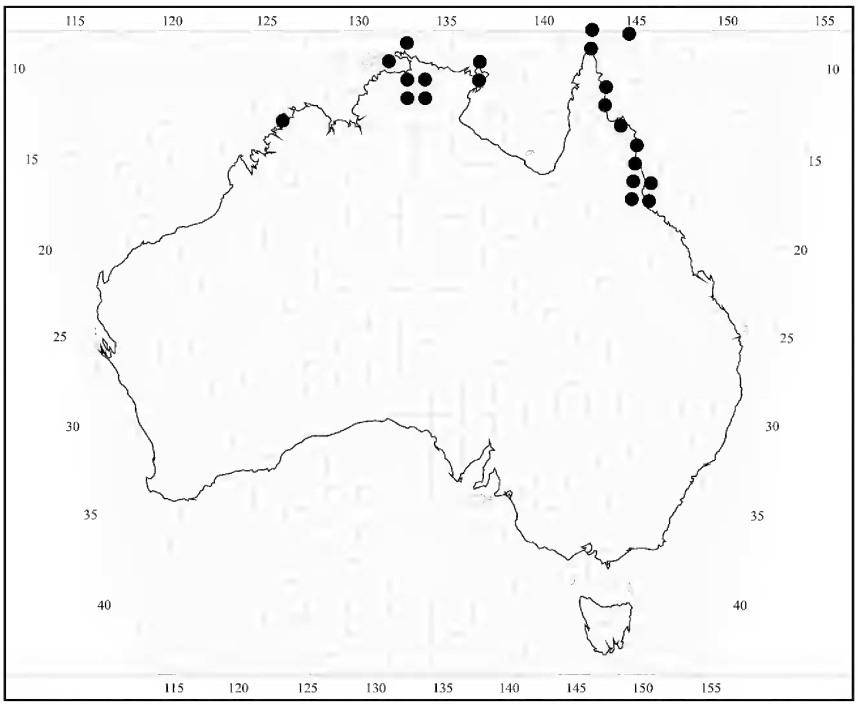
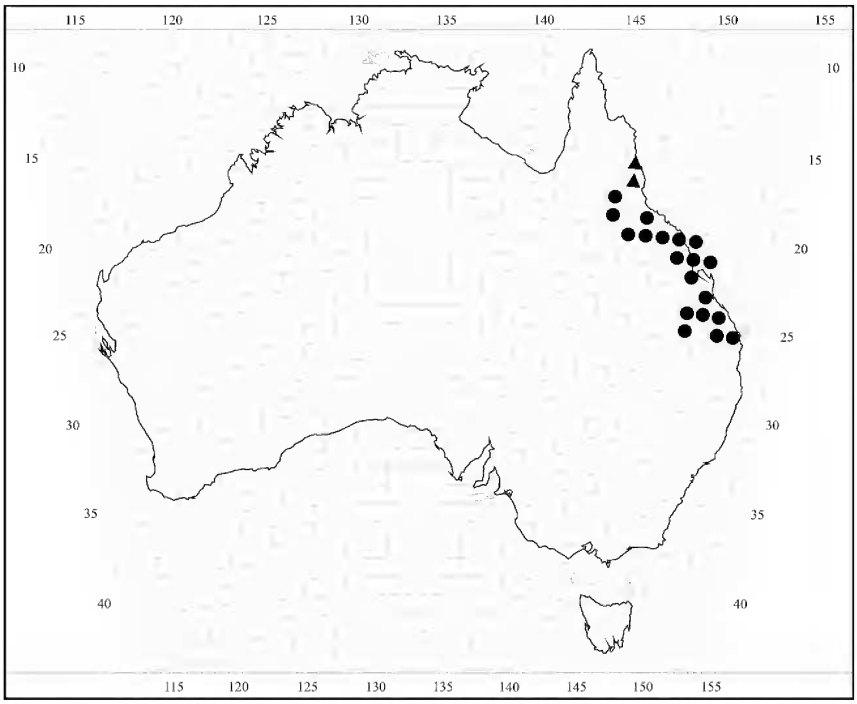


Map 1. Distribution in 1° grids in Australia for *Claoxylon angustifolium*▲ and *Claoxylon australe* ●.



Map 2. Distribution in 1° grids in Australia for *Claoxylon hillii* ●.



Map 3. Distribution in 1° grids in Australia for *Claoxylon tenerifolium* subsp. *tenerifolium* ● *and Claoxylon tenerifolium* subsp. *boreale* ▲.